

A Simple Adjustable Pole Mount for Deploying DIDSON and Split-Beam Transducers

H.J. Enzenhofer and G. Cronkite

Fisheries and Oceans Canada
Science Branch, Pacific Region
Pacific Biological Station
Nanaimo, BC V9T 6N7

2005

**Canadian Technical Report of
Fisheries and Aquatic Sciences 2570**



Fisheries
and Oceans

Pêches
et Océans

Canada

Canadian Technical Report of Fisheries and Aquatic Sciences

Technical reports contain scientific and technical information that contributes to existing knowledge but which is not normally appropriate for primary literature. Technical reports are directed primarily toward a worldwide audience and have an international distribution. No restriction is placed on subject matter and the series reflects the broad interests and policies of the Department of Fisheries and Oceans, namely, fisheries and aquatic sciences.

Technical reports may be cited as full publications. The correct citation appears above the abstract of each report. Each report is abstracted in *Aquatic Sciences and Fisheries Abstracts* and indexed in the Department's annual index to scientific and technical publications.

Numbers 1 - 456 in this series were issued as Technical Reports of the Fisheries Research Board of Canada. Numbers 457 - 714 were issued as Department of the Environment, Fisheries and Marine Service Technical Reports. The current series name was changed with report number 925.

Technical reports are produced regionally but are numbered nationally. Requests for individual reports will be filled by the issuing establishment listed on the front cover and title page. Out-of-stock reports will be supplied for a fee by commercial agents.

Rapport technique canadien des sciences halieutiques et aquatiques

Les rapports techniques contiennent des renseignements scientifiques et techniques qui constituent une contribution aux connaissances actuelles, mais que ne sont pas normalement appropriés pour la publication dans un journal scientifique. Les rapports techniques sont destinés essentiellement à un public international et ils sont distribués à cet échelon. Il n'y a aucune restriction quant au sujet; de fait, la série reflète la vaste gamme des intérêts et des politiques du ministère des Pêches et des Océans, c'est-à-dire les sciences halieutiques et aquatiques.

Les rapports techniques peuvent être cités comme des publications complètes. Le titre exact paraît au-dessus du résumé de chaque rapport. Les rapports techniques sont résumés dans la revue *Résumés des sciences aquatiques et halieutiques*, et ils sont classés dans l'index annuel des publications scientifiques et techniques du Ministère.

Les numéros 1 à 456 de cette série ont été publiés à titre de rapports techniques de l'Office des recherches sur les pêcheries du Canada. Les numéros 457 à 714 sont parus à titre de rapports techniques de la Direction générale de la recherche et du développement, Service des pêches et de la mer, ministère de l'Environnement. Les numéros 715 à 924 ont été publiés à titre de rapports techniques du Service des pêches et de la mer, ministère des Pêches et de l'Environnement. Le nom actuel de la série a été établi lors de la parution du numéro 925.

Les rapports techniques sont produits à l'échelon régional, mais numérotés à l'échelon national. Les demandes de rapports seront satisfaites par l'établissement auteur dont le nom figure sur la couverture et la page du titre. Les rapports épuisés seront fournis contre rétribution par des agents commerciaux.

Canadian Technical Report of
Fisheries and Aquatic Sciences 2570

2005

A SIMPLE ADJUSTABLE POLE MOUNT FOR DEPLOYING DIDSON AND
SPLIT-BEAM TRANSDUCERS

by

H.J. Enzenhofer¹ and G. Cronkite²

¹Fisheries and Oceans Canada
Cultus Lake Salmon Research Laboratory
4222 Columbia Valley Highway
Cultus Lake, BC V2R 5B6

²Fisheries and Oceans Canada
Science Branch, Pacific Region
Pacific Biological Station
Nanaimo, BC V9T 6N7

© Her Majesty the Queen in Right of Canada, 2005
Cat. No. Fs 97-6/2570E ISSN 0706-6457

Correct citation for this publication:

Enzenhofer, H.J., and Cronkite, G. 2005. A simple adjustable pole mount for
deploying DIDSON and split-beam transducers. Can. Tech. Rep. Fish.
Aquat. Sci. 2570: iv + 14 p.

TABLE OF CONTENTS

ABSTRACT	iv
INTRODUCTION	1
DESCRIPTION	1
CONSTRUCTION and ASSEMBLY	2
SLIDE AND RECEIVER BRACKET	2
Assembly	2
MAIN VERTICAL POLE	2
Assembly	3
ONE METER EXTENSIONS	3
ACCESSORY PLATE AND CHANNEL FOR ADDING A SECOND TRANSDUCER	4
HINGE PLATE FOR 90 DEGREE TRANSDUCER ROTATION	4
DEPLOYMENT	4
STATIONARY DEPLOYMENT USING A MODIFIED STEP-LADDER	5
DISCUSSION and CONCLUSION	6
ACKNOWLEDGEMENTS	8
REFERENCES	8

ABSTRACT

Enzenhofer, H.J., and Cronkite, G. 2005. A simple adjustable pole mount for deploying DIDSON and Split-beam transducers. Can. Tech. Rep. Fish. Aquat. Sci. 2570: iv + 14 p.

We have designed an adjustable pole mount that attaches to a boat or other stationary platform. The mount allows the precise aim of an acoustic transducer. The mount allows manual control of the deployment depth, bearing, roll angle and tilt angle of an attached split-beam transducer or DIDSON dual imaging sonar transducer. It can be attached to boat gunnels up to 27 cm thick, or to a stationary platform such as a modified stepladder for riverine applications. We describe the construction, assembly and deployment of the stainless steel and powder-coated aluminium pole mount. We also describe the add-on attachments that allow: 1) the extension of the mount by 1 m; 2) the addition of a second transducer and; 3) the 90° rotation of a DIDSON transducer for bottom profiling.

RESUME

Enzenhofer, H.J., and Cronkite, G. 2005. A simple adjustable pole mount for deploying DIDSON and Split-beam transducers. Can. Tech. Rep. Fish. Aquat. Sci. 2570: iv + 14 p.

Le présent rapport porte sur la conception d'une perche réglable qui peut être fixée à un bateau ou à une autre plate-forme stationnaire. La perche permet d'orienter un transducteur acoustique avec précision. Elle permet la commande manuelle de la profondeur, de l'azimut, de l'angle de roulis et de l'angle d'inclinaison du déploiement d'un transducteur à faisceau divisé ou d'un transducteur sonar d'imagerie à deux fréquences DIDSON. La perche peut être fixée au plat-bord d'un bateau, d'une épaisseur maximale de 27 cm, ou à une plate-forme stationnaire, telle une échelle modifiée, pour les applications riveraines. Le rapport décrit la construction, le montage et le déploiement de la perche en acier inoxydable et en aluminium enduit de poudre. Il décrit également les accessoires complémentaires qui permettent : 1) l'extension de la perche de 1 m; 2) l'ajout d'un deuxième transducteur; et 3) la rotation de 90° d'un transducteur DIDSON pour les profils bathymétriques.

INTRODUCTION

Advancements in hydroacoustic technology have led to the development of acoustic systems such as the split-beam echosounder (MacLennan and Simmonds, 1992) and recently, the (DIDSON) dual imaging sonar system (Sound Metrics, 2004). These acoustic systems have broadened our ability to monitor fish passage in water bodies that were not accessible to earlier acoustic technology. As acoustic technology advances, often the development of accessory equipment to deploy the systems is overlooked. Deployment of the transducers requires specialised equipment that is dependable, relatively simple to operate and capable of producing precise alignment of acoustic beams. We have designed a bracket that mounts to a stable platform and allows the user to manually control the depth, bearing, roll angle and tilt angle of an attached transducer.

This report describes the design, construction and method of deployment of an adjustable pole mount designed for aiming an acoustic transducer. We also include details of attachment brackets which allow the user to add a second transducer, rotate a transducer 90 degrees, or to extend the pole mount an additional 1 m and we describe a modified step-ladder, which can be used as a stationary platform for the mount and as a visual counting tower. The mount we describe can be attached to boat gunnels up to 27 cm thick for mobile use, or to a modified step-ladder or other type of mount for stationary deployments on a riverbank or lakeshore. The Applied Technologies group of the Department of Fisheries and Oceans is currently using the adjustable pole mount to operate a DIDSON dual-frequency identification transducer (Sound Metrics, 2004) for estimating Pacific salmon (*Oncorhynchus spp.*) spawning ground escapement in selected Fraser River tributary systems. Similar pole mounts designed and constructed by us are currently being used to monitor Pacific salmon in the Fraser River, British Columbia, by the Pacific Salmon Commission and several important river systems in Alaska by the Alaska Department of Fish and Game.

DESCRIPTION

The adjustable pole mount consists of two basic components: 1) a slide and receiver bracket which clamps to a boat gunnel or other secured platform and; 2) vertical poles which control the aim configuration of an attached transducer (Fig. 1).

The main vertical pole is connected to the slide and receiver bracket with removable pins that allow the mount to be pivoted out of the water for storage or into the water for data collection. Once deployed the adjustable pole mount is held at a desired depth by a locking sleeve which acts as a safety stop and a bearing surface for adjusting aim angle. The horizontal aiming angle of the beam is controlled with the two handles at the top of the mount and the vertical aiming angle is adjusted by turning the tilt adjustment crank.

CONSTRUCTION AND ASSEMBLY

SLIDE AND RECEIVER BRACKET

The slide and receiver bracket is constructed of powder-coated aluminium with moving parts that ride on ultra-high molecular weight (UHMW) polyethylene (Fig. 2). The receiver consists of an L-shaped bracket made from a 20.8 cm x 37 cm plate welded at right angles to a 20.8 cm x 13 cm plate both 6 mm thick. The slide is cradled in two pieces of 4.5 cm x 5 cm x 37 cm of UHMW bolted to the top plate, each having a 6 mm groove running its length (Fig.2, Fig.3). The slide, 6 mm thick x 15.2 cm wide, has two 16.3 cm x 13.7 cm plates welded at one end to sandwich the main vertical pole holder. A removable boat-clamp fits on the underside of the receiver, which will tighten an adjustable clamp plate, 6 mm x 8 cm x 20.8 cm, by a ratchet consisting of two ½ inch bolts.

Assembly

The receiver bracket will fit boat gunnels and other mounting platforms up to 27 cm thickness. Wider widths can be accommodated by increasing the total length of both the slide and receiver when the mount is constructed. Assembly is in the following order:

1. Remove the safety lock block on the slide.
2. Pull the spring loaded pin and remove the slide completely from the receiver.
3. Align the adjustable clamp plate to the set of bolt holes in the top plate, which best fit the width of the supporting structure.
4. Tighten the adjustable clamp plate and sandwich the mounting platform between the two rubber pads.
5. Insert the slide and compress the spring loaded pin to replace slide fully into the receiver.
6. Replace the safety lock block once past the stop block on the receiver.
7. The affixed slide and receiver bracket is now ready to accept the main vertical pole by attachment to the main vertical pole holder.

MAIN VERTICAL POLE

The main vertical pole is constructed of 5 cm diameter stainless steel (SS) pipe with a turning platform welded to the top and a transducer mounting plate bolted to the bottom. The transducer mounting plate connects to the main vertical pole with an attaching collar (Fig. 4). The attaching collar (5 cm diameter aluminium) has a ¾ inch SS bolt at one end and a bolting flange on the other end. The attaching collar is designed to be tightened into a ¾ inch threaded aluminium block at the bottom of the main vertical pole and held in place with a

locking pipe clamp. The adjustable pole mount is 1.5 m long, but its overall length can be extended with the addition of two 1 m SS extensions.

The pitch angle (vertical aiming angle of the beam relative to the water surface) of an attached transducer is controlled by the travel of a 2.5 cm diameter SS pipe (1.3 m length) connected to the tilt adjustment crank on top and to the transducer mounting plate on bottom. The tilt adjustment crank runs through a $\frac{3}{4}$ inch SS nut inside a cage welded to the top of the turning platform and a $\frac{3}{4}$ inch brass nut mounted to the top of the 2.5 cm SS pipe (Fig. 3).

Assembly

The main vertical pole and turning unit with handles are one piece that has all other pieces such as transducer plates, tilt adjustment crank, 1 m extensions, lock collar sleeve and connection to the slide and receiver attached. Assembly is in the following order:

A. Add the pieces which mount to the main vertical pole (5 cm SS pipe).

1. Locking sleeve (Fig. 3).
2. Main vertical pole holder (Fig. 2).
3. Locking pipe clamp (Fig. 4).
4. Attaching collar (Fig. 4).
5. Bolt on the transducer mounting plate (Fig. 4).

B. Assemble the tilt adjustment crank to the transducer mounting plate.

1. Insert the $\frac{3}{4}$ inch SS nut (NC thread) into the cage frame and remove $\frac{5}{16}$ inch Allen key (Fig. 3).
2. Insert the tilt adjustment crank into $\frac{3}{4}$ inch caged nut cranking down to a point where a dimple in the $\frac{3}{4}$ inch NC thread is visible through the hole drilled in the $\frac{3}{4}$ inch SS nut.
3. Insert the $\frac{5}{16}$ inch Allen key and tighten.
4. Thread the SS pipe with the $\frac{3}{4}$ inch brass nut onto the tilt adjustment crank approximately 12 cm.
5. Bolt bottom flange of SS pipe to bracket on the transducer mounting plate.

ONE METER EXTENSIONS

The bracket extensions consist of two SS pipes that extend the adjustable pole mount to a total length of 2.5 m (Fig. 4). The 1 m extension for the main vertical pole (5 cm diameter) has a $\frac{3}{4}$ inch SS bolt on one end and a $\frac{3}{4}$ inch threaded aluminium block on the other end. The 1 m extension for the 2.54 cm SS pipe has bolting attachment points on both ends and is inserted between the transducer plate and the tilt adjustment crank. Installation of the 1 m extensions is as follows:

1. Unbolt the transducer plate from the main vertical pole and the tilt adjustment crank.
2. Loosen the locking pipe clamp and remove the attaching collar.
3. Insert the 1 m extension for 5 cm SS pipe and tighten pipe clamp.
4. Insert attaching collar, add pipe clamp then bolt to transducer plate.
5. Insert 1 m extension for the 2.54 cm pipe and bolt to transducer plate and bottom of the tilt adjustment crank.

ACCESSORY PLATE AND CHANNEL FOR ADDING A SECOND TRANSDUCER

The transducer mount plate has two $\frac{3}{8}$ inch bolt holes on its outer edge for adding an additional plate, 31(25.5) cm x 23 cm x 6 mm, and an aluminium channel, when a second transducer is to be used (Fig. 4). The offset in the aluminium plate will allow a cylindrically cased, split-beam transducer to be attached alongside a DIDSON transducer. The aluminium channel has three slotted holes on either side for securing a transducer with hose clamps. Subsequent adjustments in the aiming configuration will be identical for both transducers as they are attached to a common plate.

HINGE PLATE FOR 90 DEGREE TRANSDUCER ROTATION

We have also designed a hinged bracket that allows the rotation of a DIDSON transducer up to 90° (Fig. 5). The SS hinged bracket plate has the same dimensions as the transducer plate and a hinge that attaches to the transducer plate in the bolt holes provided for adding a second transducer (Fig. 4). There is a pivot arm welded to the hinged bracket plate that travels through a small holding bracket that is welded to the transducer plate (Fig. 5). Once the hinge is assembled a safety bolt is added to the pivot arm and allows the hinge to move down to 90° rotation, but not beyond. In addition, the small bracket added to the transducer plate has a tightening wing nut to hold the main plate anywhere from 0° to 90° rotation.

DEPLOYMENT

When using the adjustable pole mount, the width of the attachment point (e.g. boat gunnel) needs to be measured. Next, the appropriate location to bolt the adjustable clamp to the receiver must be selected. Once the slide and receiver are positioned, the vertical poles with the mounted transducer are attached with $\frac{1}{2}$ inch SS pins. One pin will go through the bottom holes of both the main vertical pole holder and the slide. The second $\frac{1}{2}$ inch pin is inserted through the top hole of the main vertical pole holder and to one set of holes on the slide, depending on the desired angle for the vertical poles. There are provisions in the slide to allow the vertical pole to be angled at 15°, 0°, -15°, -30°

and -45° with respect to the water surface. The depth of deployment is controlled by adjusting the location of the locking sleeve on the main vertical pole.

There are also provisions in the slide and receiver bracket to move the transducer away from the side of the boat or stationary platform. Once everything has been assembled the slide can be moved in the receiver by compressing the spring-loaded pin (Fig.2) and moving slide to another bolt hole in the receiver bracket. The safety lock block ensures that the unit cannot be pushed totally out of the receiver.

Adjustments in the aiming angles for the transducer are controlled two ways. First, the upstream/downstream for river application or fore/aft direction for boat application are controlled by turning the handles which swivels the pole mount on the main vertical pole holder. Second, the surface/bottom angle (pitch) is controlled by turning the tilt adjustment crank. We have devised a method for measuring the pitch angle thus allowing repeatability of aiming configurations. The following steps outline our method:

1. From field measurements we discovered that for every 10 mm that the $\frac{3}{4}$ inch brass nut travelled along the tilt adjustment crank the transducer plate changed 5° . (The measurement was accomplished by setting a carpenter's protractor on the transducer plate, levelling to 0° , and turning the tilt adjustment crank in 5° increments from $+45^\circ$ to -45°).
2. Based on the field results we scored a 60 cm section of the 2.54 cm SS pipe with a pipe cutter at 10 mm spacing.
3. A pointer consisting of 65 mm x 6 mm diameter SS rod welded to a pipe clamp was attached to the main vertical pole (Fig. 6).
4. The transducer plate is levelled with the protractor and the pointer is aligned to the closest 10 mm spaced mark and clamped. This mark will then represent the 0° point and subsequent changes can be read directly from the pointer and the 5° increments represented by the 10 mm spaced marks.

STATIONARY DEPLOYMENT USING A MODIFIED STEP-LADDER

An aluminium step-ladder was modified to provide both a stationary platform for the adjustable pole mount and a tower for performing visual counts in clear water rivers (Photo 1, Fig. 6). A bracket consisting of a $\frac{3}{4}$ inch inside diameter pipe section with a tightening nut was added to each leg to hold a rebar steel pin driven into the river bottom. The step-ladder had a working platform to which we added an aluminium channel for mounting the slide and receiver portion of the adjustable pole mount. Some bracing with rope from the receiver to the top of the step-ladder was added to reduce flow induced vibrations.



Photo 1. A modified step-ladder used as a stationary platform for the adjustable pole mount and as a visual counting tower for migrating fish at Lingfield Creek on the Chilko River, a clear water tributary of the Fraser River watershed.

DISCUSSION AND CONCLUSION

We have found that the adjustable pole mount is an inexpensive and effective method of deploying a transducer. This type of mount is all that is required if systematically repeated multiple aims are not being used, and if the transducer is easily accessible as in a near surface application. Aim configurations were repeatable and did not require costly electronic equipment such as a dual axis rotator, rotator controller, operating software, or a position sensor often used in acoustic data collection.

The modified step-ladder was an effective method of providing a stationary mount in fast flowing rivers. The working platform on the step-ladder allowed us to compare data sets recorded by the DIDSON sonar system to simultaneous visual counts of migrating fish (Holmes et al, in press).

The hinge plate for DIDSON transducer was constructed to allow the user to rotate the transducer 90° for bottom profiling. In normal operation the DIDSON beam does not give the vertical location of an object in the water column but does give the range and horizontal direction of travel relative to the transducer. By rotating the DIDSON unit 90° , the vertical location of an object can be determined.

We used the 1 m extensions on the pole mount to monitor passage of Sockeye salmon (*O. nerka*) and Chinook salmon (*O. tshawytscha*) at Henry's Bridge on the Chilko River. Fish passage was near shore and the deployment site had a high bank that was approximately 1 m above the water surface. We erected the modified step-ladder on the edge of the riverbank and used the extensions to place the DIDSON transducer near-shore and in sufficient water depth to monitor the fish passage. We also used the pole mount and the DIDSON with various types of boats to investigate the movement of sockeye salmon in deeper water areas of the Fraser River including the areas around an operating fish wheel to determine the sockeye swimming behaviour (Photo 2). The mount proved versatile and useful in many different types of situations. The pole mount can also be used in an active fashion, allowing the user to examine an underwater area of interest.

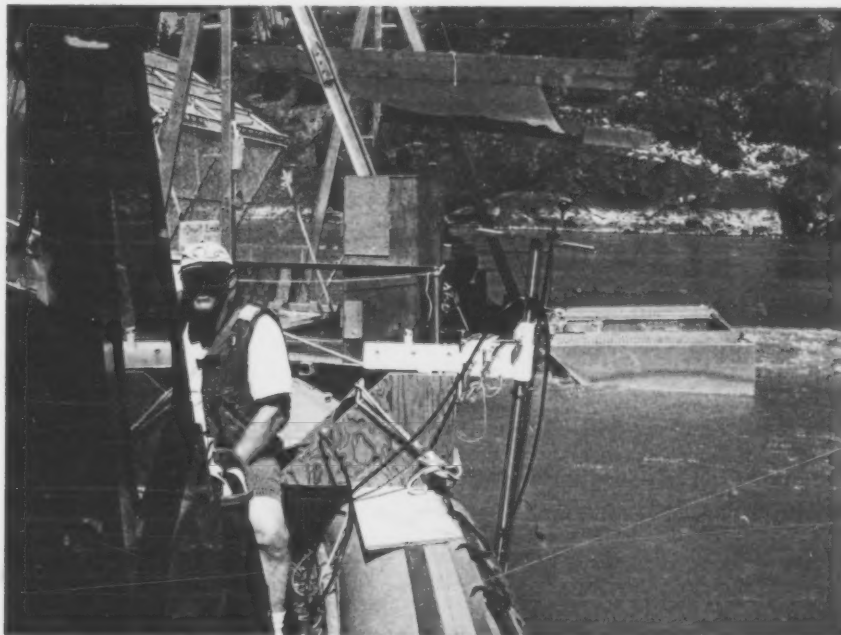


Photo 2. The adjustable pole mount attached to a rigid hull inflatable boat. A DIDSON dual imaging sonar transducer is being used to monitor fish behaviour around a fish wheel deployed at Siska Canyon on the Fraser River, British Columbia.

ACKNOWLEDGEMENTS

The authors thank Stan De Jong and Dave Shaw for their valuable input into the design concepts for the adjustable pole mount. Stan De Jong was instrumental during the construction phase of the mount along with S.T.I. Steeltec Industries of Chilliwack, B.C. Itsuo Yesaki provided the specification drawings contained within this report. The authors would like to thank Dr. John Holmes, Jeremy Hume and Vivian Magnusson for editing and formatting this report.

REFERENCES

- MacLennan, D.N., and Simmonds, E.J. 1992. Fisheries Acoustics, pp.57, 85, 145, Chapman and Hall, London. 325 p.
- Sound Metrics Corporation. 2004. Dual-Frequency Identification Sonar DIDSON Operational Manual V4.47.
- Holmes, J.A., G.M.W. Cronkite, and H.J. Enzenhofer. (In Press). Feasibility of implementing the DIDSON acoustic imaging system to estimate sockeye salmon escapement in major tributary systems of the Fraser River, British Columbia. Can. Tech. Rep. Fish. Aquat. Sci.

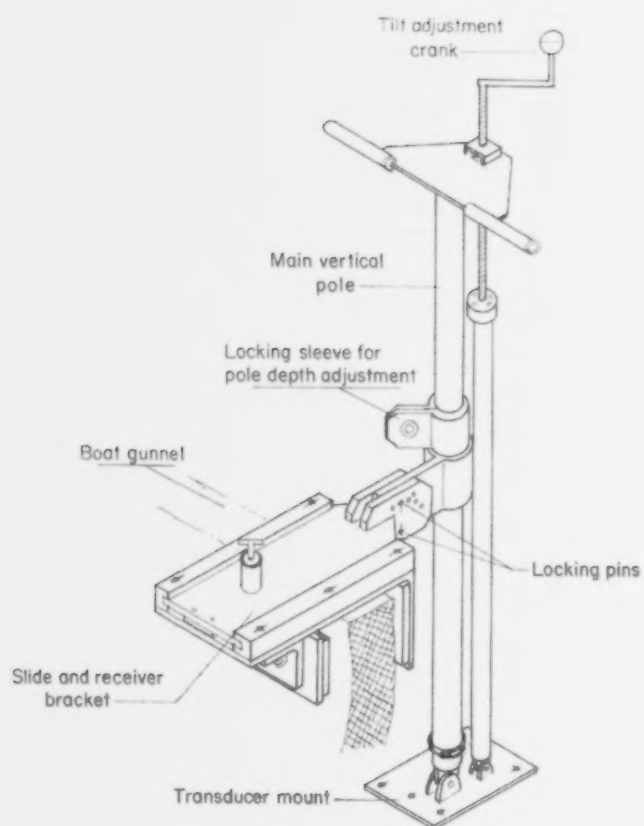


Fig. 1. Three-dimensional view of the adjustable pole mount attached to a boat.

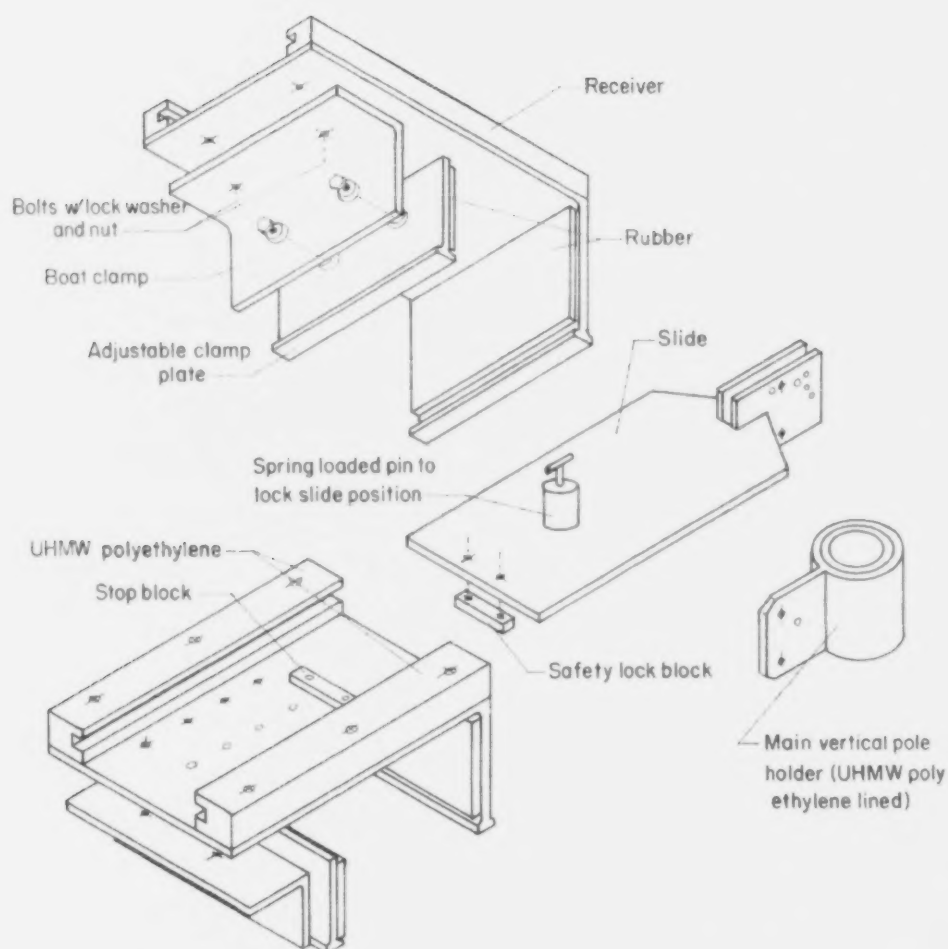


Fig. 2. Exploded view of the slide and receiver bracket for attaching to a stationary platform.

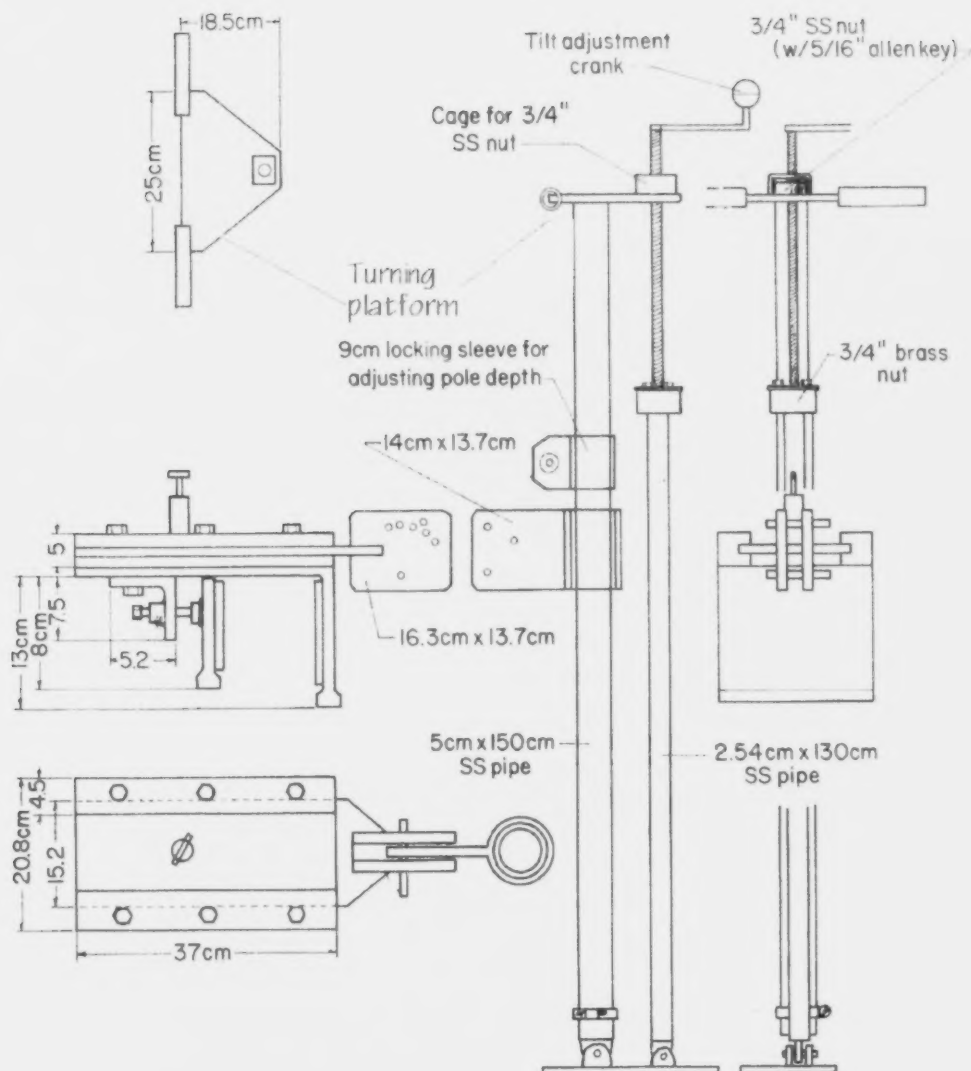


Fig. 3. Schematic of the adjustable pole mount showing dimensions. The top diagram is a top view of the turning platform. The two diagrams (bottom left) show a side view and top view of the slide and receiver bracket. The two diagrams to the right show a side view and front view of the vertical poles.

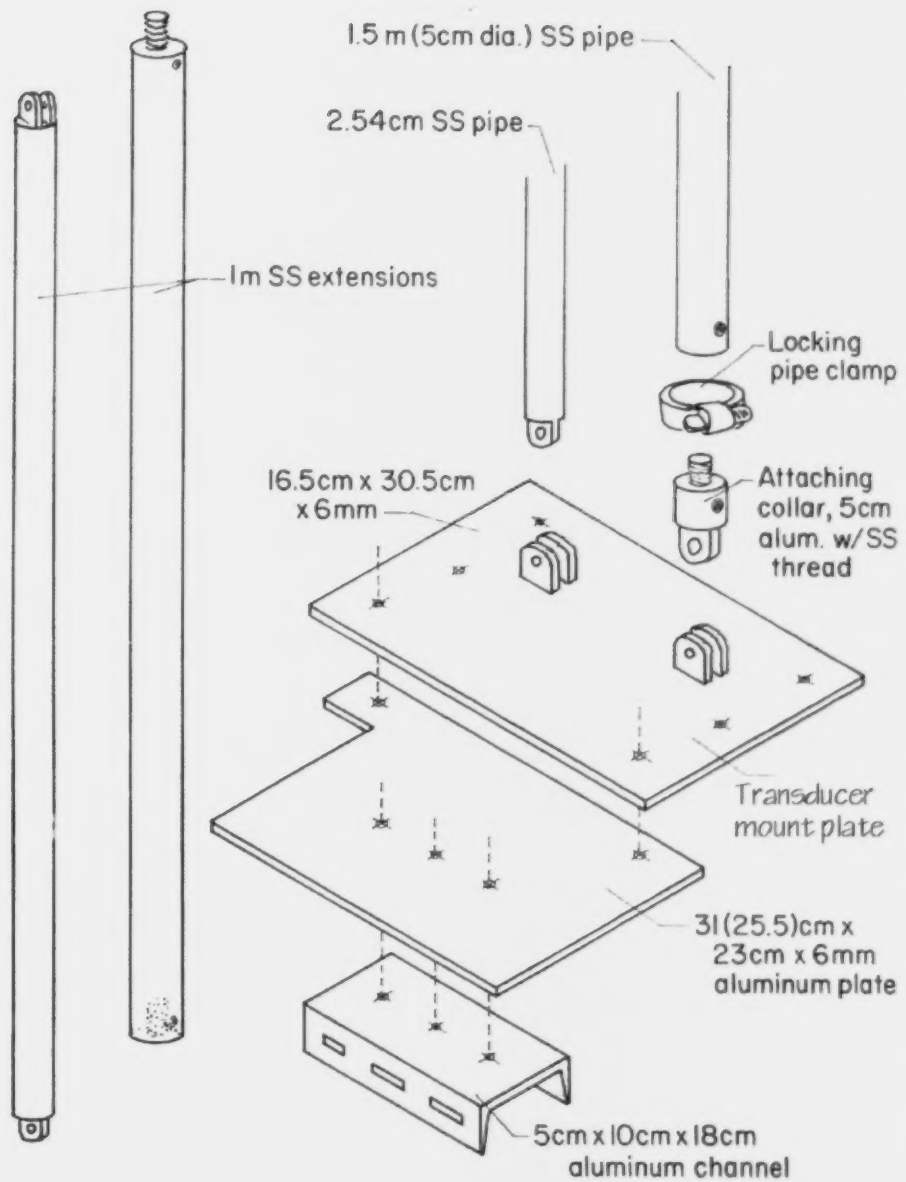


Fig. 4. Exploded view of the 1 m extensions and the accessory plate with aluminium channel for adding a second transducer.

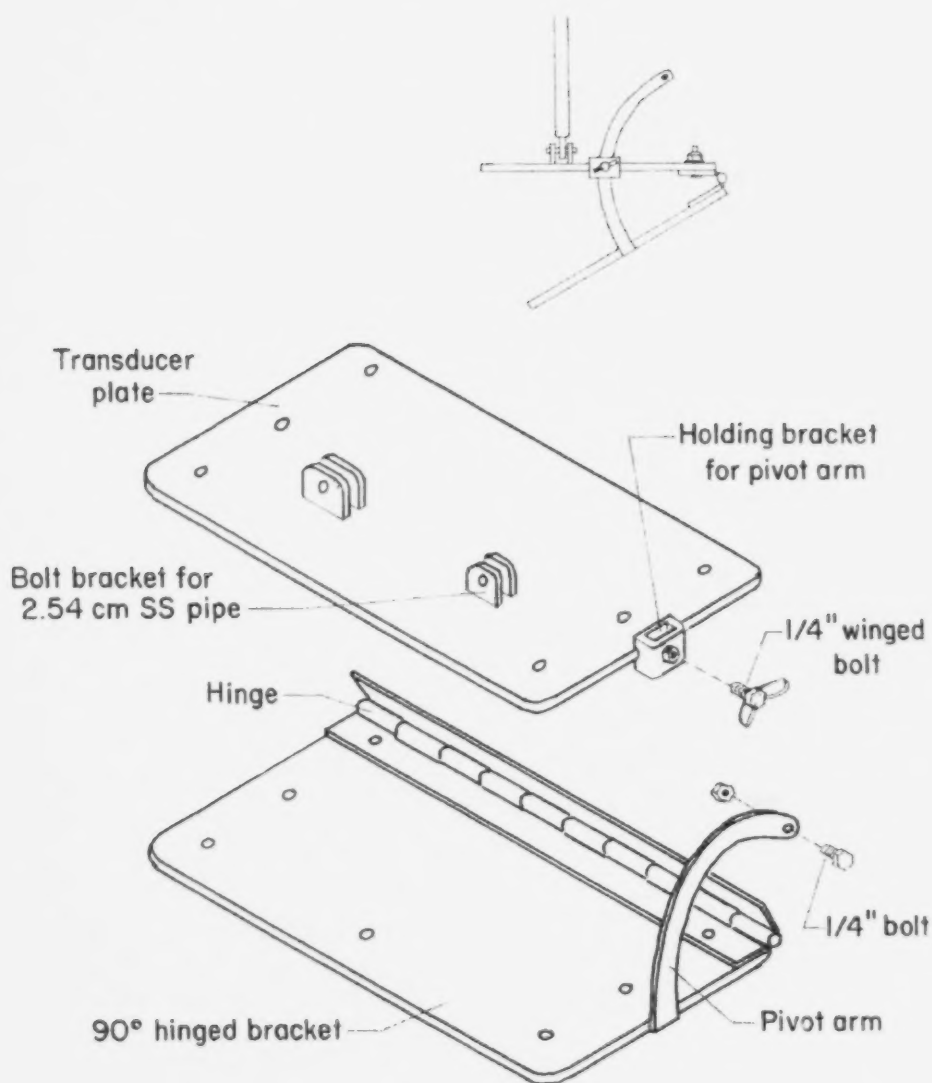


Fig. 5. Three-dimensional view of the 90° hinge bracket: the top diagram shows the unit assembled to the transducer plate; and, the middle diagram shows the holding bracket for the pivot arm which must be welded to the transducer plate of the adjustable pole mount.

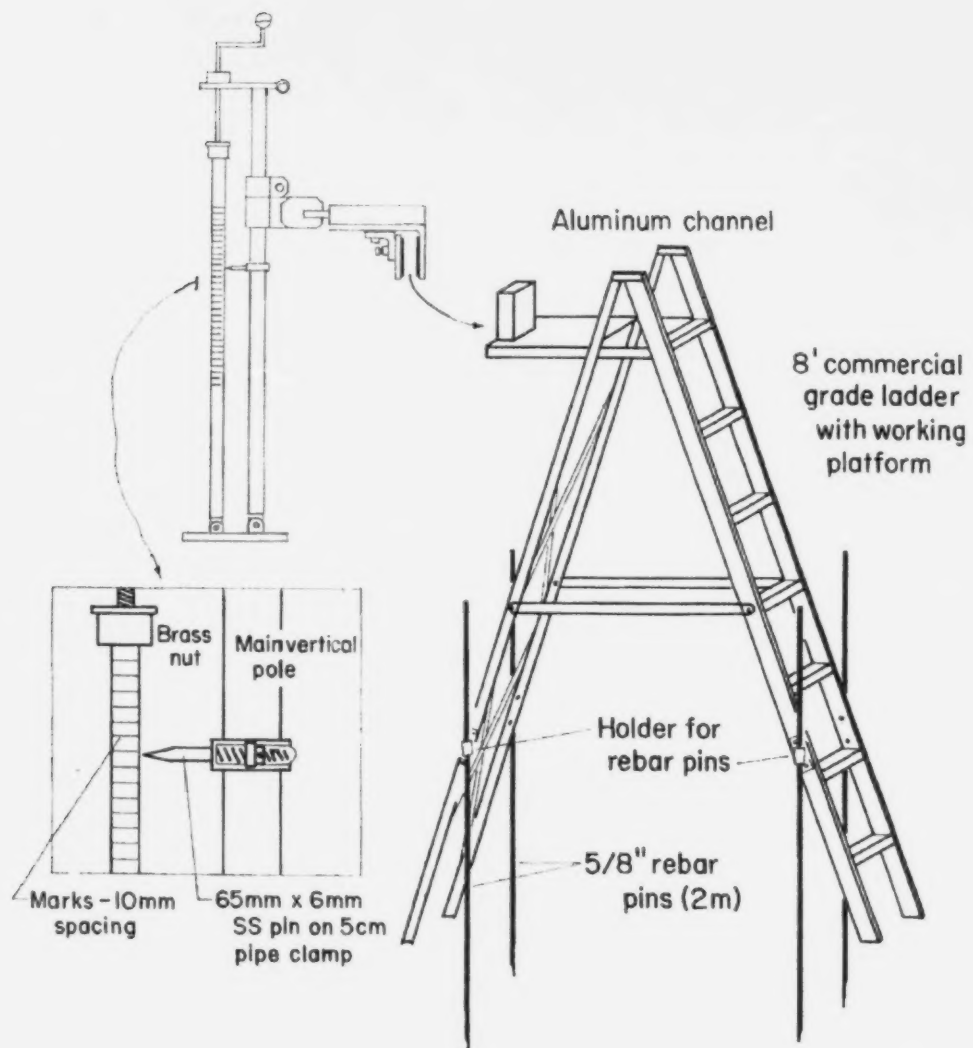


Fig. 6. Three-dimensional view of a modified stepladder for anchoring to a riverbed or riverbank with a working platform to attach the adjustable pole mount. The enlarged diagram shows the stainless steel pointer mounted to the main vertical pole and used to measure the travel of the tilt adjustment crank.

